

WHAT IS CLAIMED IS:

1. A plasma display device having a plasma display panel including at least a plurality of discharge cells each having at least a sustain electrode pair for generating sustain discharge for a light emission display,  
5 wherein said plasma display device is configured to apply a sustain pulse voltage between said sustain electrode pair in a respective one of said plurality of discharge cells to generate a sustain discharge in a respective one of the following operating modes selected based upon use of said plasma display device:
  - (a) generating a pre-discharge and then a main discharge;
  - (b) generating a main discharge without a pre-discharge preceding said main discharge; and
  - (c) switching between the mode (a) and the mode (b),  
15 wherein at least a first-waveform voltage and a second-waveform voltage are provided for use as said sustain pulse voltage,
  - said first-waveform voltage is composed of a first portion having a major portion of a first voltage and a second portion having a major portion of a second voltage higher than said first voltage,
  - 20 said second-waveform voltage is composed of a third portion having a major portion of a third voltage and a fourth portion having a major portion of a fourth voltage higher than said third voltage,
  - said first-waveform voltage and said second-waveform voltage satisfy the following conditions (i) and (ii):
    - 25 (i) at least one of the following inequalities is satisfied:

said third voltage  $>$  said first voltage,

a time duration of said third portion  $>$  a time duration of said first portion which includes 0 seconds, and

(ii) at least one of the following inequalities is satisfied:

5 said fourth voltage  $>$  said second voltage,

a time duration of said fourth portion  $>$  a time duration of said second portion which includes 0 seconds,

wherein said plasma display device is provided with a circuit for switching said sustain pulse voltage from said first-waveform voltage to said second-waveform voltage based upon an increase of an amount of a load factor, where said load factor is a ratio of a number of lighted ones of said plurality of discharge cells during said sustain discharge to a total number of said plurality of discharge cells, and wherein said first and third voltages are established by using at least  
10  
15 a switch and one of a power supply and ground potential.

2. A plasma display device having a plasma display panel including at least a plurality of discharge cells each having at least a sustain electrode pair for generating sustain discharge for a light emission display,

20 wherein said plasma display device is configured to apply a sustain pulse voltage between said sustain electrode pair in a respective one of said plurality of discharge cells to generate a sustain discharge in a respective one of the following operating modes selected based upon use of said plasma display device:

25 (a) generating a pre-discharge and then a main discharge;

(b) generating a main discharge without a pre-discharge preceding said main discharge; and

(c) switching between the mode (a) and the mode (b),

wherein at least a first-waveform voltage and a second-waveform

5 voltage are provided for use as said sustain pulse voltage,

said first-waveform voltage is composed of a first portion having a major portion of a first voltage and a second portion having a major portion of a second voltage higher than said first voltage,

said second-waveform voltage is composed of a third portion  
10 having a major portion of a third voltage and a fourth portion having a major portion of a fourth voltage higher than said third voltage,

said first-waveform voltage and said second-waveform voltage satisfy the following conditions (i) and (ii):

(i) at least one of the following inequalities is satisfied:

15 said third voltage  $>$  said first voltage,

a time duration of said third portion  $>$  a time duration of said first portion which includes 0 seconds, and

(ii) at least one of the following inequalities is satisfied:

said fourth voltage  $>$  said second voltage,

20 a time duration of said fourth portion  $>$  a time duration of said second portion which includes 0 seconds,

wherein said plasma display device is provided with a circuit for switching said sustain pulse voltage from said first-waveform voltage to said second-waveform voltage based upon an increase of an amount

25 of a load factor, where said load factor is a ratio of a number of

lighted ones of said plurality of discharge cells during said sustain discharge to a total number of said plurality of discharge cells, and wherein two electrodes of said sustain electrode pair are supplied with two voltages opposite in polarity from each other, respectively.

5           3. A plasma display device having a plasma display panel including at least a plurality of discharge cells each having at least a sustain electrode pair for generating sustain discharge for a light emission display,

wherein said plasma display device is configured to apply a sustain  
10 pulse voltage between said sustain electrode pair in a respective one of said plurality of discharge cells to generate a sustain discharge in a respective one of the following operating modes selected based upon use of said plasma display device:

- (a) generating a pre-discharge and then a main discharge;
- 15 (b) generating a main discharge without a pre-discharge preceding said main discharge; and
- (c) switching between the mode (a) and the mode (b),

wherein at least a first-waveform voltage and a second-waveform voltage are provided for use as said sustain pulse voltage,

20           said first-waveform voltage is composed of a first portion having a major portion of a first voltage and a second portion having a major portion of a second voltage higher than said first voltage,

          said second-waveform voltage is composed of a third portion having a major portion of a third voltage and a fourth portion having  
25 a major portion of a fourth voltage higher than said third voltage,

said first-waveform voltage and said second-waveform voltage satisfy the following conditions (i) and (ii):

(i) at least one of the following inequalities is satisfied:

said third voltage  $>$  said first voltage,

5 a time duration of said third portion  $>$  a time duration of said first portion which includes 0 seconds, and

(ii) at least one of the following inequalities is satisfied:

said fourth voltage  $>$  said second voltage,

a time duration of said fourth portion  $>$  a time duration of said second  
10 portion which includes 0 seconds,

wherein said plasma display device is provided with a circuit for switching said sustain pulse voltage from said first-waveform voltage to said second-waveform voltage based upon an increase of an amount of a load factor, where said load factor is a ratio of a number of  
15 lighted ones of said plurality of discharge cells during said sustain discharge to a total number of said plurality of discharge cells, and wherein said first and third voltages are established by using an inductance coupled to one of a power supply and ground potential.

4. A plasma display device having a plasma display panel  
20 including at least a plurality of discharge cells each having at least a sustain electrode pair for generating sustain discharge for a light emission display and an address electrode for selecting one to be lighted from among said plurality of discharge cells,  
wherein said plasma display device is configured to apply a sustain  
25 pulse voltage between said sustain electrode pair in a respective one

of said plurality of discharge cells to generate a sustain discharge in a respective one of the following operating modes selected based upon use of said plasma display device:

(a) generating a pre-discharge and then a main discharge;

5 (b) generating a main discharge without a pre-discharge preceding said main discharge; and

(c) switching between the mode (a) and the mode (b),

wherein said address electrode is supplied with an address pulse voltage synchronized with said sustain pulse voltage during said  
10 sustain discharge, and said address pulse voltage is increased based upon an increase of an amount of a load factor, where said load factor is a ratio of a number of lighted ones of said plurality of discharge cells during said sustain discharge to a total number of said plurality of discharge cells.

15 5. A plasma display device according to claim 1, wherein a repetition period of said second-waveform is longer than that of said first-waveform.

6. A plasma display device according to claim 2, wherein a repetition period of said second-waveform is longer than that of said  
20 first-waveform.

7. A plasma display device according to claim 3, wherein a repetition period of said second-waveform is longer than that of said first-waveform.

8. A plasma display device according to claim 1, wherein said  
25 first-waveform and second-waveform voltages include post-discharge

voltages higher than said second and fourth voltages, respectively.

9. A plasma display device according to claim 2, wherein said first-waveform and second-waveform voltages include post-discharge voltages higher than said second and fourth voltages, respectively.

5 10. A plasma display device according to claim 3, wherein said first-waveform and second-waveform voltages include post-discharge voltages higher than said second and fourth voltages, respectively.

11. A plasma display device according to claim 1, wherein said plasma display device further comprises a circuit for calculating said  
10 load factor and a control circuit for selecting one of said first-waveform and second-waveform voltages based upon said load factor.

12. A plasma display device according to claim 2, wherein said plasma display device further comprises a circuit for calculating said  
15 load factor and a control circuit for selecting one of said first-waveform and second-waveform voltages based upon said load factor.

13. A plasma display device according to claim 3, wherein said plasma display device further comprises a circuit for calculating said  
20 load factor and a control circuit for selecting one of said first-waveform and second-waveform voltages based upon said load factor.

14. A plasma display device according to claim 4, wherein said plasma display device further comprises a circuit for calculating said  
25 load factor and a control circuit for controlling said address pulse

voltage based upon said load factor.

15. A plasma display device according to claim 11, wherein said sustain pulse voltage is selected so as to generate said pre-discharge when said load factor exceeds a predetermined value.

5        16. A plasma display device according to claim 12, wherein said sustain pulse voltage is selected so as to generate said pre-discharge when said load factor exceeds a predetermined value.

17. A plasma display device according to claim 13, wherein said sustain pulse voltage is selected so as to generate said pre-discharge  
10 when said load factor exceeds a predetermined value.

18. A plasma display device according to claim 14, wherein said sustain pulse voltage is selected so as to generate said pre-discharge when said load factor exceeds a predetermined value.

19. A plasma display device according to 11, wherein said  
15 plasma display device further comprises a table listing a relationship among said load factors, numbers of said sustain pulses of said first-waveform and second-waveform voltages, and luminance of said discharge cells, and at a boundary load factor at which a changeover is performed from said first-waveform voltage to said second-waveform  
20 voltage, numbers of sustain pulses of said first-waveform and second-waveform voltages are selected by using said table such that two luminances produced by discharges generated by said first-waveform and second-waveform voltages, respectively, are approximately equal to each other.

25        20. A plasma display device according to 12, wherein said



plasma display device further comprises a table listing a relationship among said load factors, numbers of said sustain pulses of said first-waveform and second-waveform voltages, and luminance of said discharge cells, and at a boundary load factor at which a changeover  
5 is performed from said first-waveform voltage to said second-waveform voltage, numbers of sustain pulses of said first-waveform and second-waveform voltages are selected by using said table such that two luminances produced by discharges generated by said first-waveform and second-waveform voltages, respectively, are  
10 approximately equal to each other.

21. A plasma display device according to 13, wherein said plasma display device further comprises a table listing a relationship among said load factors, numbers of said sustain pulses of said first-waveform and second-waveform voltages, and luminance of said  
15 discharge cells, and at a boundary load factor at which a changeover is performed from said first-waveform voltage to said second-waveform voltage, numbers of sustain pulses of said first-waveform and second-waveform voltages are selected by using said table such that two luminances produced by discharges generated by said first-  
20 waveform and second-waveform voltages, respectively, are approximately equal to each other.

22. A plasma display device according to 13, wherein said plasma display device further comprises a table listing a relationship among said load factors, numbers of said sustain pulses of said sustain  
25 pulse voltage, said address voltage and luminance of said discharge

cells, and at a boundary load factor at which a changeover is performed in said address voltage, said address voltages are selected by using said table such that two luminances produced by discharges generated by said address voltages before and after said changeover, respectively, are approximately equal to each other.

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